

A woman with long dark hair is looking down at a tablet she is holding. The image is overlaid with a semi-transparent blue filter. The text is centered over the image.

RESEARCH METHODOLOGY AND IPR (RMIK23507)

MODULE-1

INTRODUCTION

The word research is composed of two syllables “Re” and “Search”. “Re” is the prefix meaning ‘Again or over again or a new’ and “Search” is the latter meaning ‘to examine closely and carefully’ or ‘to test and try’.



COURSE OUTCOMES

Upon completion of the course, students will be able to:

CO1: Understand the research problem by literature review to solve problems.

CO2: Develop skills in qualitative and quantitative data analysis and presentation.

CO3: Develop advanced critical thinking skills.

CO4: Understand to write the report writing and awareness about IPR.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PROGRAM OUTCOMES

6. **Engineer and World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
7. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
9. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
10. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
11. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS):

PEO1: Acquire technical knowledge of fundamentals of basic sciences, electronics and communication engineering and applied mathematics for the rapid changes in technology.

PEO2: Analyze, design, apply, evaluate and solve complex problems in technology and management through engineering skills.

PEO3: Demonstrate team spirit by applying ethics and professional behavior.

PEO4: Involve in research and development in the field of electronics and communication engineering and multi-disciplinary areas for lifelong learning.

PROGRAM SPECIFIC OUTCOMES

PSO1: Analyze, design and implement emerging electronics and communication systems using devices, subsystems and networking.

PSO2: Exhibit technical skills necessary to choose careers in the design, implement and testing, management and operation of Electronics and Communication circuits and systems.

SYLLABUS

SEMESTER – V

Course: Research Methodology and IPR

Course Code	RMIK23507	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Objectives:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive static and dynamic aero elastic equations of motion.
CLO4	To understand the different types of IPR

Content
Module 1 (08 hours) RESEARCH METHODOLOGY: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. DEFINING THE RESEARCH PROBLEM: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration
Module 2 (08 hours) REVIEWING THE LITERATURE: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. RESEARCH DESIGN: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs

SYLLABUS

Module 3 (08 hours)

DESIGN OF SAMPLE SURVEYS: Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

MEASUREMENT AND SCALING: Qualitative and Quantitative Data,

DATA COLLECTION: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Module 4 (08 hours)

TESTING OF HYPOTHESES: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

INTERPRETATION AND REPORT WRITING: Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research reports.

SYLLABUS

Module 5 (08 hours)

INTELLECTUAL PROPERTY: Principles of IPR, Kinds of IPR, Patent- Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions

for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights;

Textbook:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Lionel Bently., Brad Sherman-Intellectual Property Law, 3rd Edition

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be *proportionately reduced to 50*. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

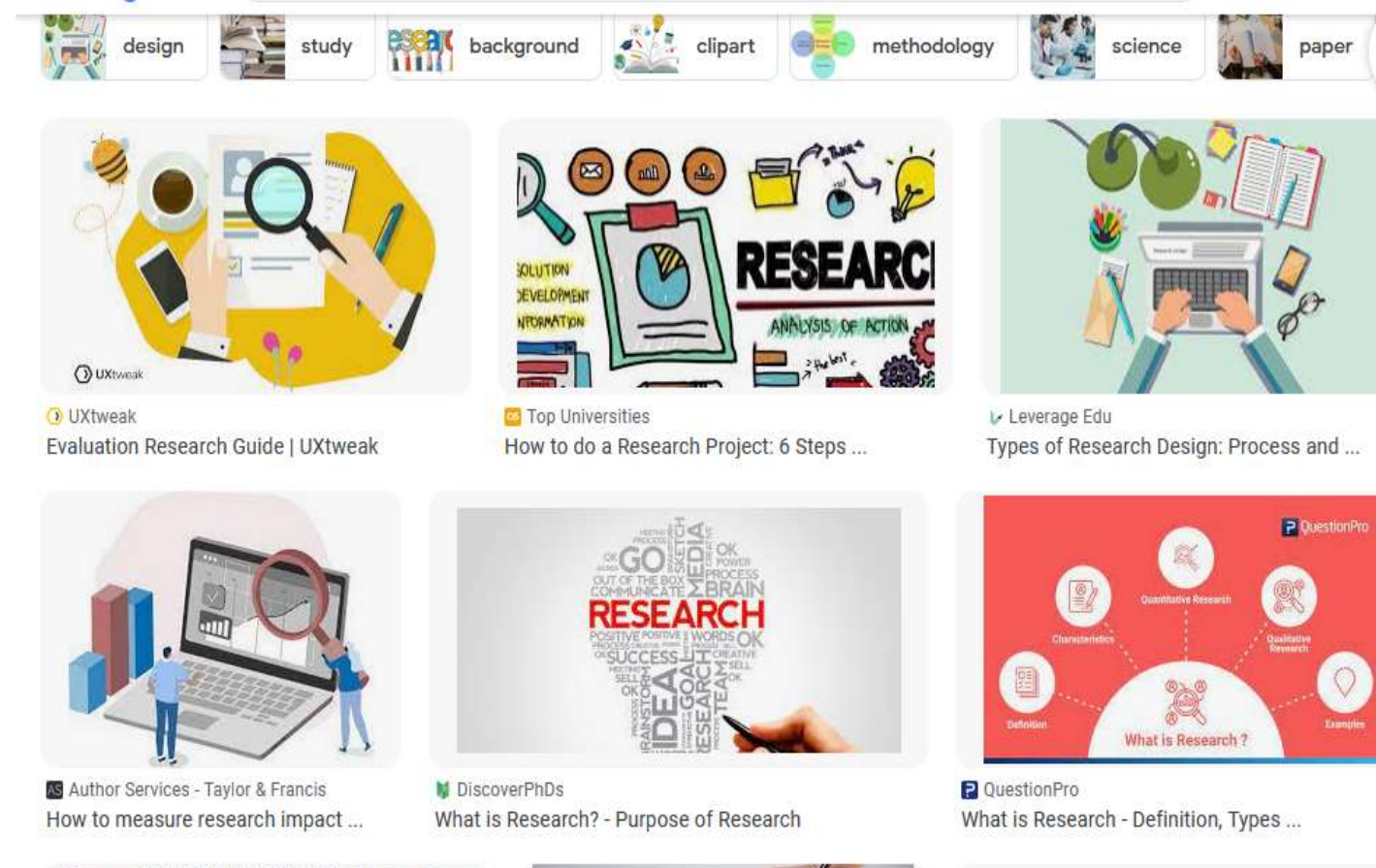
Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO MAPPING

CO/PO	PO6	PO8	PO12
CO 1	3	3	3
CO 2	3	3	3
CO 3	3	3	3
CO 4	3	3	3
Average	3	3	3

Low-1: Medium-2: High-3

INTRODUCTION TO RESEARCH



The research forms, a careful, systematic, patient study and investigation in some field of knowledge undertaken to establish principles / policies.

Meaning of Research

⑩ Search for Knowledge

⑩ Systematic and Scientific Search for getting relevant answers on any taken up specific topic.

⑩ Scientific Enquiry into a subject.

⑩ Research is a movement from the Unknown to the Known.

⑩ It is the Voyage (long journey) of Discovery

Meaning of Research

❖ **Clifford Woody (American psychologists (1884-1948))** - Research comprises *defining and redefining problems, formulating hypothesis* or suggested solutions; *collecting, organizing and evaluating data*; making *deductions and reaching conclusions*; and at last carefully testing the conclusions to determine whether they fit the formulated hypothesis.

❖ **D. Slesinger and M. Stephenson** in the Encyclopedia of Social Sciences define research as "the manipulation of things, concepts or symbols for the purpose of generalizing, to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice“.

OBJECTIVES OF RESEARCH

- The objective of research is *to find answers to the questions* by applying scientific procedures.
- In other words, the main aim of research is *to find out the truth which is hidden* and has not yet been discovered.



OBJECTIVES OF RESEARCH

Although every research study has its own specific objectives, the research objectives may be broadly grouped as follows:

1. To gain familiarity with a phenomenon or *to achieve new insights* into it (exploratory or formulative research studies)
2. To portray accurately the characteristics of a particular individual, situation or a group (descriptive research studies)
3. To determine the frequency with which something occurs or with which it is associated with something else (diagnostic research studies)
4. To test a hypothesis of a causal relationship between variables (hypothesis-testing research studies)



1. DESCRIPTIVE VS ANALYTICAL RESEARCH

Descriptive research asks “what?” It describes something. Meanwhile, **analytical research** asks “why?” We try to find out how something came to be.



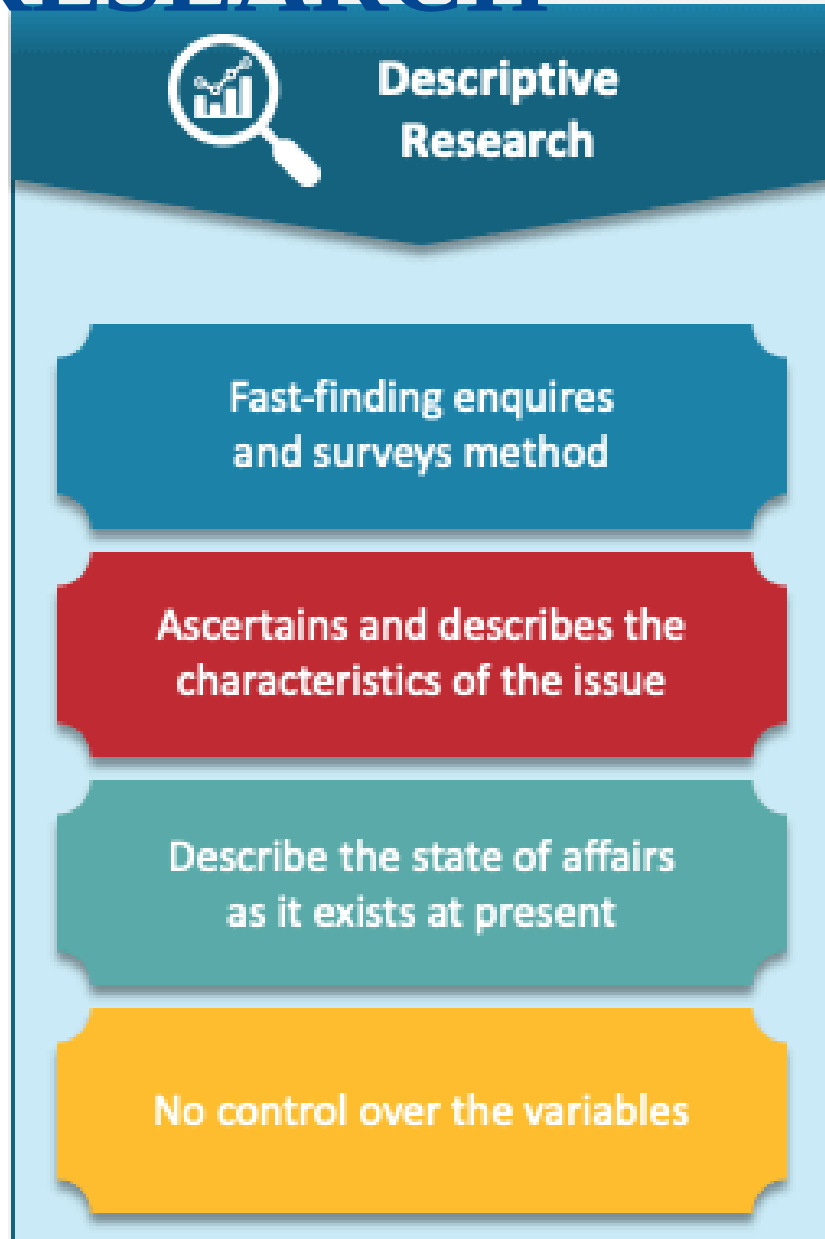
Descriptive	Analytical
How many disabled people face social isolation?	What causes social isolation in disabled people?
What is the unemployment rate for disabled people?	Why do disabled people have a harder time finding work?
How many siblings of people with Down syndrome have positive experiences?	Why do so many siblings of people with Down syndrome have positive experiences?

1. DESCRIPTIVE VS ANALYTICAL RESEARCH

- Descriptive research consists of *surveys and fact-finding enquiries of different types*.
- The main objective of descriptive research is describing the *state of affairs as it prevails at the time of study*.
- The term 'ex post facto research' is quite often used for descriptive research studies in social sciences and business research.
- The most distinguishing feature of this method is that the researcher has no control over the variables here.



I. DESCRIPTIVE VS ANALYTICAL RESEARCH



- Majority of the ex post facto research projects are used for descriptive studies in which the researcher attempts to examine phenomena, such as the consumers preferences, frequency of shopping, etc.
- Despite the inability of the researchers to control the variables, ex post facto studies may also comprise attempts by them to discover the causes of the selected problem.
- The methods of research adopted in conducting descriptive research are survey methods of all kinds, including correlational and comparative methods.

1. DESCRIPTIVE VS ANALYTICAL RESEARCH

In the **Analytical research**, the researcher has to use the *already available facts or information and analyze them* to make a critical evaluation of the subject.



Analytical Research

Collected data is analyzed and explained

Beyond merely describing the characteristics

Explains existing state of affairs from available data

Works within the constraint's variables

2. APPLIED VS FUNDAMENTAL RESEARCH

Applied Research:

- ❑ An attempt *to find a solution to an immediate problem* encountered by a firm, an industry, a business organization, or the society is known as applied research.
- ❑ Researchers engaged in such researches aim at drawing certain conclusions confronting a concrete social or business problem.

Fundamental research:

- mainly concerns *generalizations and formulation of a theory*.
- In other words, —*Gathering knowledge for knowledge's sake* is termed pure or basic research (Young in Kothari, 1988).
- Researches relating to *pure mathematics* or concerning some *natural phenomenon* are instances of Fundamental Research.
- Likewise, studies focusing on human behavior also fall under the category of fundamental research.

2. APPLIED VS FUNDAMENTAL RESEARCH

	 Applied Research	 Fundamental Research
 Objective	Solve Practical Problems	Expand Knowledge and Understanding
 Focus	Real-World Applications	Theoretical Exploration
 Timeframe	Short-Term	Long-Term
 Problem-Solving	Addresses Specific Practical Problems	Not Necessarily Focused on Problem-Solving
 Collaboration	Often Involves Industry Partners	More Individual or Academic Collaborations
 Knowledge	Builds on Existing Knowledge	Develops New Theories and Concepts
 Innovation	Improves Efficiency and Effectiveness	Unearths New Ideas and Breakthroughs
 Examples	Developing a New Drug	Studying Fundamental Particle Interactions

2. APPLIED VS FUNDAMENTAL RESEARCH

Example of fundamental research:

- How did the universe begin ?
- What are protons, neutrons and electrons composed of ?
- What is the specific genetic code of the fruit fly ?

Examples of Applied Research:

investigate ways to:

- improve agricultural crop production
- treat or cure a specific disease
- improve the energy efficiency of homes, offices, or modes of transportation.

3. QUANTITATIVE VS QUALITATIVE RESEARCH

Quantitative research

- ❖ relates to **aspects that can be quantified** or can be expressed in terms of quantity.
- ❖ involves the **measurement of quantity or amount**.
- ❖ Various available **statistical and econometric methods** are adopted for analysis in such research.
- ❖ Which includes **correlation, regressions and time series analysis** etc.



Qualitative research

- ❖ is concerned with **qualitative phenomena**, or more specifically, the aspects related to or involving **quality or kind**.
- ❖ *For example*, an important type of qualitative research is '**Motivation Research**', which investigates into the reasons for certain human behavior.
- ❖ The main aim of this type of research is discovering the underlying motives and desires using in-depth interviews.



4. CONCEPTUAL VS. EMPIRICAL RESEARCH

Conceptual Research



- The research related to some abstract idea or theory is known as conceptual research.
- Generally, philosophers and thinkers use it for developing new concepts or for reinterpreting the existing ones.

Empirical Research



- **Empirical Research**, on the other hand, exclusively relies on the observation or experience with hardly any regard for theory and system.
- Such research is data based, which often comes up with conclusions that can be verified through experiments or observation.
- Empirical research is also known as experimental type of research.

5. SOME OTHER TYPES OF RESEARCH

- i. **one-time research or longitudinal research-** depends upon the time of doing research
- ii. **field-setting research or laboratory research or simulation research-** depends upon the environment in which research is carried on.
- iii. **clinical or diagnostic research-** in-depth approaches or case study method may be employed to analyse the basic causal relations
- iv. **Exploratory research-** consist of substantial structure and specific hypotheses to be verified
- v. **Historical Research-** sources like historical documents, remains, etc. Are utilized to study past events or ideas



RESEARCH APPROACHES



RESEARCH APPROACHES

Quantitative Approach

i. Inferential research:

- inferential approach to research is to ***form a data base from which to infer characteristics or relationships of population.***
- This usually means **survey research** where a sample of population is studied (questioned or observed) to determine its characteristics, and it is then inferred that the population has the same characteristics

ii. Experimental research:

- characterized by much **greater control over the research environment** and in this case some variables are manipulated to observe their effect on other variables

iii. Simulation research:

- Simulation approach involves ***the construction of an artificial environment*** within which relevant information and data can be generated.
- This permits an ***observation of the dynamic behavior*** of a system (or its sub-system) under controlled conditions

RESEARCH APPROACHES

Qualitative Approach

- **Qualitative approach** to research generates **results either in non-quantitative form** or in the form which are not subjected to **rigorous quantitative analysis**.
- Generally, the techniques of *focus group interviews, projective techniques and depth interviews* are used.

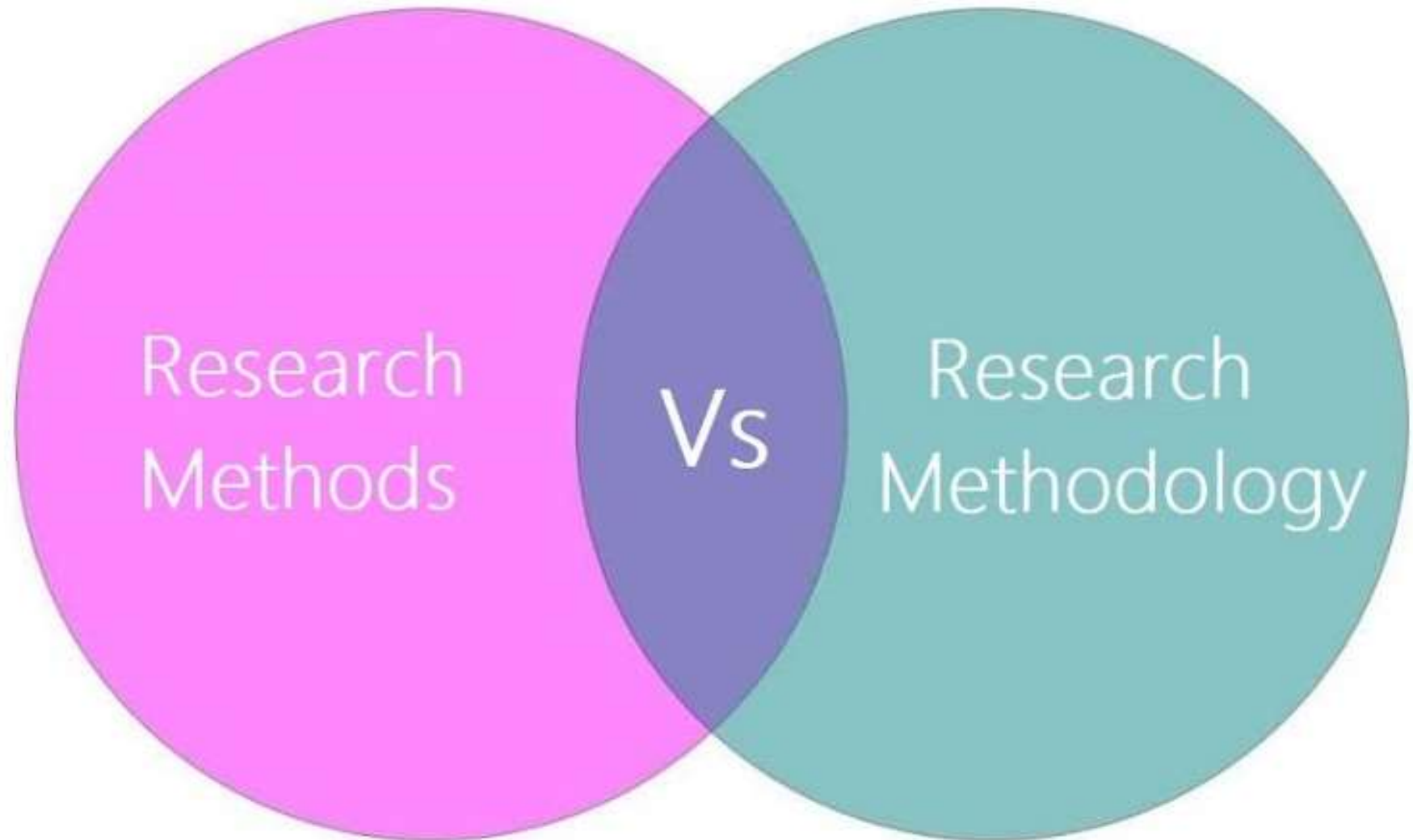
SIGNIFICANCE OF RESEARCH:

- Research inculcates **scientific and inductive thinking** and promotes the development of **logical habits of thinking**.
- Research provides the basis for all **government policies** in our economic system.
- Research has its special significance in solving **various operational and planning problems of business and industry**
- Research is equally **important for social scientists** in studying social relationships and in seeking answers to various social problems.

SIGNIFICANCE OF RESEARCH:

- a.To those students who are to write a **master's or Ph.D. thesis**, research may mean a careerism or a way to attain a high position in the social structure
- b.To **professionals in research methodology**, research may mean a source of livelihood
- c.To **philosophers and thinkers**, research may mean the outlet for new ideas and insights
- d.To **literary men and women**, research may mean the development of new styles and creative work
- e.To **analysts and intellectuals**, research may mean the generalizations of new theories

RESEARCH METHODS VERSUS METHODOLOGY



RESEARCH METHODS VERSUS METHODOLOGY

- Research methods may be understood as all those methods/techniques that are *used for conduction of research*.
- Research methods or techniques thus, refer to the methods the researchers use in performing research operations.
- Research methodology is a way to *systematically solve* the research problem.
- It may be understood as a science of studying how research is done scientifically.
- In it we study the *various steps* that are generally adopted by a researcher in studying his research problem along with the logic behind them

RESEARCH METHODS VERSUS METHODOLOGY

- **Research methods** may be understood as all those methods/techniques that are *used for conduction of research*.
- Research methods or techniques thus, refer to the methods the researchers use in performing research operations.
- **Research methodology** is a way to *systematically solve* the research problem.
- It may be understood as a science of studying how research is done scientifically.
- In it we study the *various steps* that are generally adopted by a researcher in studying his research problem along with the logic behind them

Research Method	Research methodology
Research methods refers to all those methods/techniques that are used for conduction of research. Research methods or techniques	Research methodology is a way to systematically solve the research problem. The scope of research methodology is wider than that of research methods
It involves conduction of experiments, tests, surveys etc	Techniques that can be used to conduct the experiments, tests etc
Aims at finding a solution to the research problem	Aims at employment of correct procedure to find the solution

RESEARCH AND SCIENTIFIC METHOD

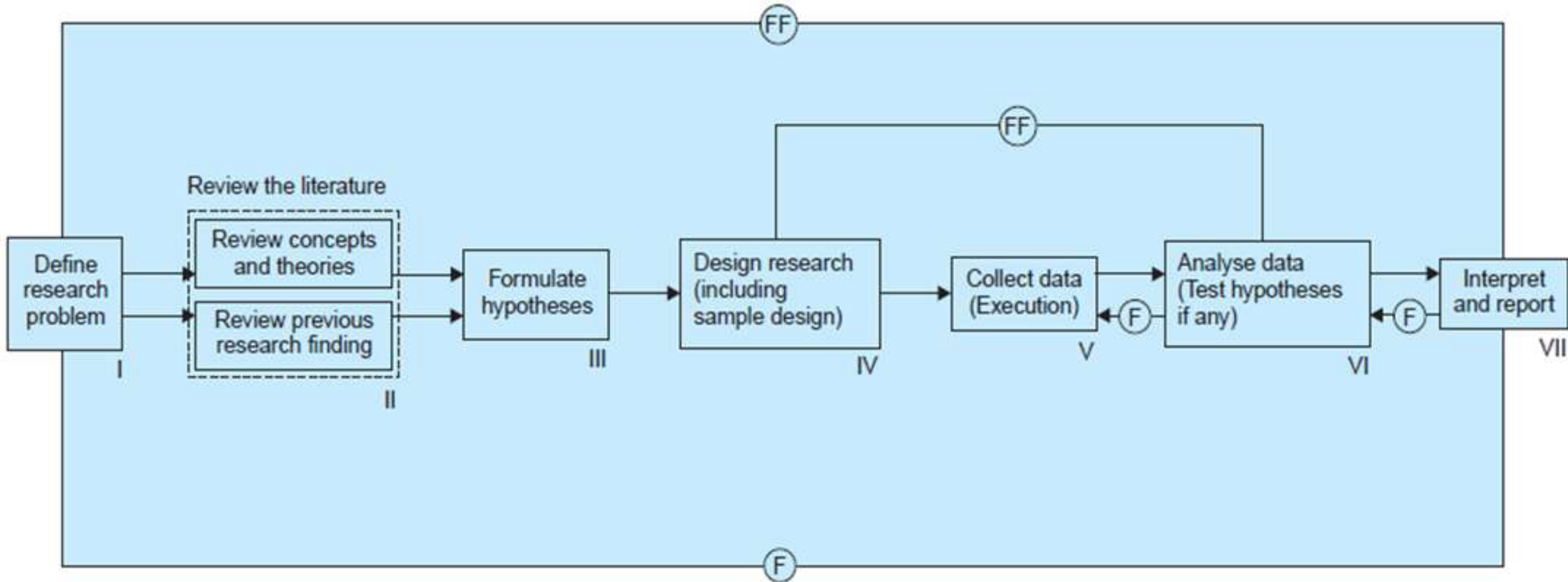
- The two terms, research and scientific method, are closely related.
- **Research** - termed as “*an inquiry into the nature of, the reasons* for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur.
- The **philosophy common to all research methods and techniques**, although they may vary considerably from one science to another, is usually given the name of **scientific method**.
- **Karl Pearson writes**, “*The scientific method is one and same in the branches (of science) and that method is the method of all logically trained minds ... the unity of all sciences consists alone in its methods, not its material; the man who classifies facts of any kind whatever, who sees their mutual relation and describes their sequences, is applying the Scientific Method and is a man of science.*”

RESEARCH AND SCIENTIFIC METHOD

The scientific method is, based on the following basic postulates:

- It relies on **empirical evidence**
- It utilizes **relevant concepts**
- It is committed to only **objective considerations**
- It **presupposes ethical neutrality**, i.e., it aims at nothing but making only adequate and correct statements about population objects
- It results into **probabilistic predictions**
- Its methodology is **made known to all concerned for critical scrutiny** are for use in testing the conclusions through replication
- It aims at **formulating most general axioms** or what can be termed as scientific theories.

RESEARCH PROCESS



Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps.

Where (F) = feed back (Helps in controlling the sub-system to which it is transmitted)
(FF) = feed forward (Serves the vital function of providing criteria for evaluation)

RESEARCH PROCESS

The various steps in a research process are as follows:

- (1) formulating the research problem
- (2) extensive literature survey
- (3) developing the hypothesis
- (4) preparing the research design
- (5) determining sample design
- (6) collecting the data
- (7) execution of the project
- (8) analysis of data
- (9) hypothesis testing
- (10) generalizations and interpretation
- (11) preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached.

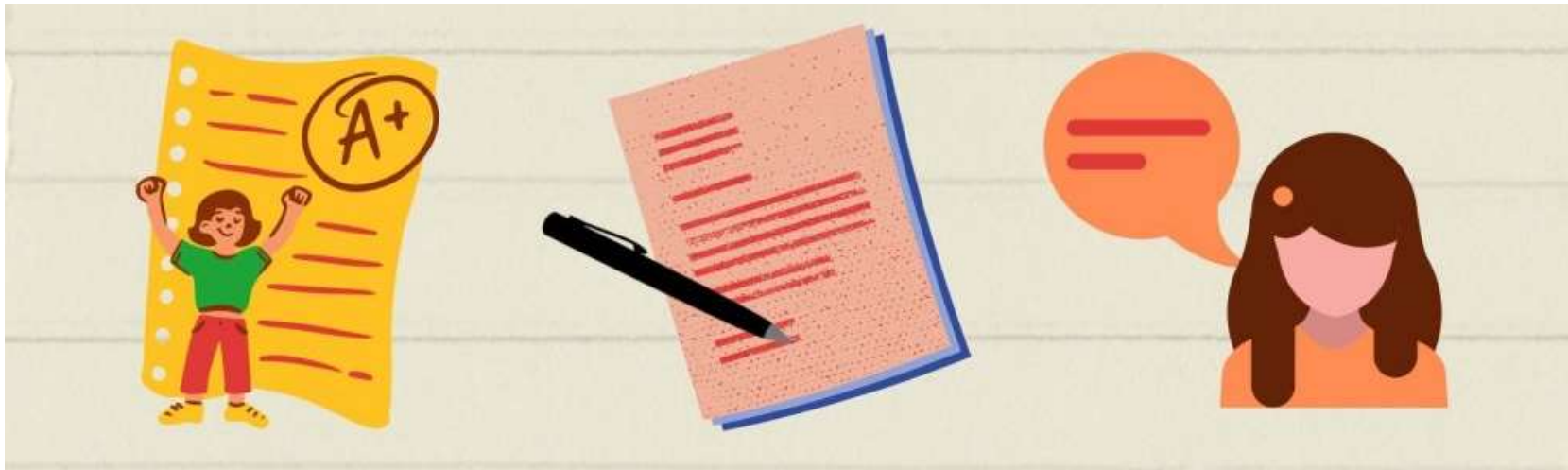


(1)Formulating a Research problem

- In research process, the first step a researcher does is formulate a problem and define it properly.
- Research forms a circle.
- It starts with a problem and ends with a solution to the problem.
- A research problem is anything that a researcher finds unsatisfactory or unsettling, a difficulty of some sort, a state of affairs that needs to be changed, anything that is not working well as it was expected (Creswell, 2009).

A problem statement consists of four parts:

1. the ideal
2. the reality or real situation
3. the consequences or impacts,
4. what the study wants to address or the aim of the study.



(2) Extensive Literature Survey

Abstracting and indexing Journals, conference proceedings, government reports, books etc.



(3) Development of Working Hypothesis

A tentative assumption made to test its logical or empirical consequences. The role of hypothesis is to guide the researcher by delimiting the area and keep him on right track.

Steps to develop a working hypothesis:

- i. Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution
- ii. Examination of data and records,
- iii. Review of similar studies in the area or of the studies on similar problems
- iv. Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals.



(4) Prepare the Research Design:



- state the **conceptual structure** within which Research will be conducted
- Several research designs- **Experimental and Non-Experimental Hypothesis testing.**
- Experimental design can be either informal or formal.

(5) Determining Sample Design:

Census Survey, Sample Survey Types of Sampling

- Deliberate sampling
- Simple random sampling
- Systematic sampling
- Stratified sampling
- Quota sampling
- Cluster sampling and area sampling
- Multi-stage sampling
- Sequential sampling



(6) Data Collection:



- Observation
- Personal Interview
- Telephone Interview
- Questionnaires
- Schedules



(7) Execution of the Project: In a systematic manner and time

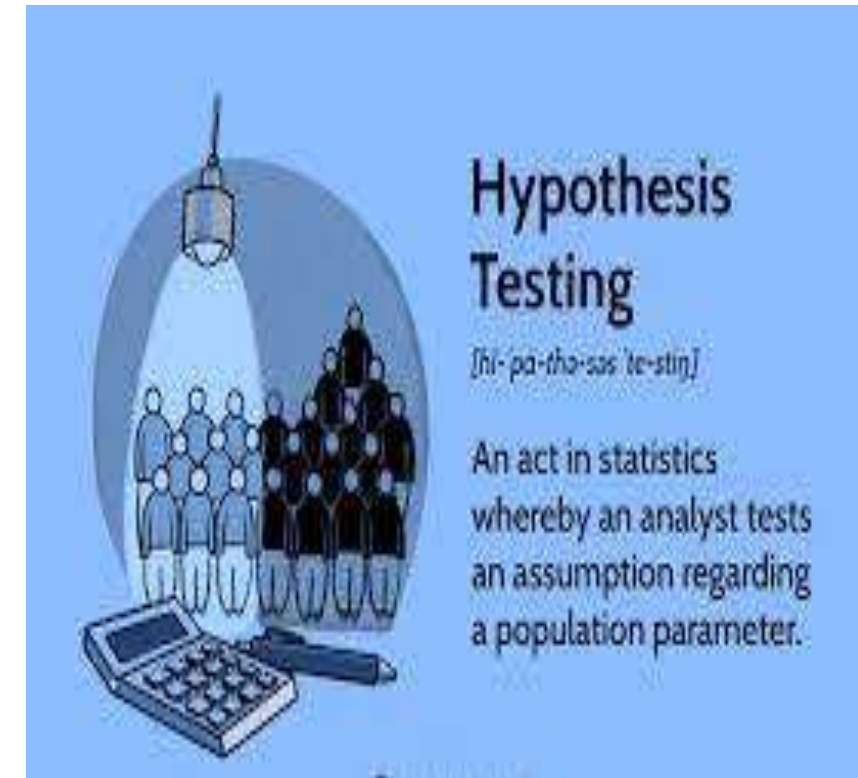
(8) Analysis of Data:



The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences.

(9) Hypothesis Testing

- ❖ Various tests, such as Chi square test, t-test, F-test, have been developed by statisticians for testing the hypothesis.
- ❖ The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry.
- ❖ Hypothesis-testing will result in either accepting the hypothesis or in rejecting it.



(10) Generalization and Interpretations



- ✓ If a hypothesis is tested and upheld several times, researcher may arrive at generalization, i.e., to build a theory.
- ✓ As a matter of fact, the real value of research lies in its ability to arrive at certain generalizations.
- ✓ If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as *interpretation*.

(11)Report or thesis writing

(a) layout

- Preliminary pages
- Main text
- End matter



(b) **concise and objective style** in simple language avoiding vague expressions such as ‘it seems,’ ‘there may be’, and the like.

(c) **Charts and illustrations** should be used only if they present the information more clearly and forcibly.



(d) various constraints experienced **in conducting research operations** must be mentioned.

Criteria of Good Research

Whatever may be the types of research works and studies, one thing that is important is that they all meet on the common ground of scientific method employed by them. One expects scientific research to satisfy the following criteria.

1. The purpose of the research should be clearly defined, and common concepts be used.
2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained.
3. The procedural design of the research should be carefully planned to yield results that are as objective as possible.



4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.
5. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully.
6. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

In other words, we can state the qualities of a good research as under:

1. Good research is systematic

- It means that research is **structured with specified steps** to be taken in a specified sequence in accordance with the **well-defined set of rules**.
- Systematic characteristic of the research does not rule out creative thinking **but it certainly does reject the use of** guessing and intuition in arriving at conclusions.



2. Good research is logical:

- This implies that research is guided by the **rules of logical reasoning** and the logical process of **induction and deduction** are of great value in carrying out research.
- **Induction** is the process of reasoning from a part to the whole whereas **deduction** is the process of reasoning from some premise to a conclusion which follows from that very premise.
- In fact, logical reasoning makes research more meaningful in the context of decision making.



3. Good research is empirical:

It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.



4. Good research is replicable:

This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Problems Encountered by Researchers in India



Problems Encountered by Researchers in India

Researchers in India, particularly those engaged in empirical research, are facing several problems. Some of the important problems are as follows:

1. The lack of a scientific training in the methodology of research is a great impediment for researchers in our country. There is paucity of competent researchers.
2. There is insufficient interaction between the university research departments on one side and business establishments, government departments and research institutions on the other side.
3. Most of the business units in our country do not have the confidence that the material supplied by them to researchers will not be misused and as such they are often reluctant in supplying the needed information to researchers.
4. Research studies overlapping one another are undertaken quite often for want of adequate information. This results in duplication and fritters away resources.
5. There does not exist a code of conduct for researchers and inter-university and interdepartmental rivalries are also quite common.

6. Many researchers in our country also face the difficulty of adequate and timely secretarial assistance, including computerial assistance. University Grants Commission must play a dynamic role in solving this difficult.
7. Library management and functioning is not satisfactory at many places and much of the time and energy of researchers are spent in tracing out the books, journals, reports, etc., rather than in tracing out relevant material from them.
8. There is also the problem that many of our libraries are not able to get copies of old and new Acts/Rules, reports and other government publications in time.
9. There is also the difficulty of timely availability of published data from various government and other agencies doing this job in our country.
10. There may, at times, take place the problem of conceptualization and also problems relating to the process of data collection and related things.

DEFINING THE RESEARCH PROBLEM



Defining the Research Problem



- The **first and foremost stage in the research process is to select and properly define the research problem.**
- A researcher should first **identify a problem and formulate it,** so as to make it amenable or susceptible to research.
- In general, a research problem refers to an **unanswered question** that a researcher might encounter in the context of either a **theoretical or practical situation**, which he/she would like to answer or find a solution to.

Defining the Research Problem

A research problem is generally said to exist if the following conditions emerge (Kothari, 1988):

- i. There should be an individual or an organization, say X, to whom the Problem can be attributed. The individual or the organization is situated in an environment Y, which is governed by certain uncontrolled variables Z.
- ii. There should be at least two courses of action to be pursued, say A1 and A2. These courses of action are defined by one or more values of the controlled variables. *For example, the number of items purchased at a specified time is said to be one course of action.*
- iii. There should be at least two alternative possible outcomes of the said courses of action, say B1 and B2. Of them, one alternative should be preferable to the other. That is, at least one outcome should be what the researcher wants, which becomes an objective.
- iv. The courses of possible action available must offer a chance to the researcher to achieve the objective, but not the equal chance. Putting it in simple words, it means that the choices must not have equal efficiencies for the desired outcome.

Thus, the components of a research problem may be **summarized** as:

- a) There should be **an individual or a group who have some difficulty or problem.**
- b) There must be **some objective(s) to be attained at.** If one wants nothing, one cannot have a problem.
- c) There should be **alternative ways of pursuing the objective** the researcher wants to pursue. This implies that there should be more than one alternative means available to the researcher. This is because if the researcher has no choice of alternative means, he/she would not have a problem.
- d) There should be **some doubt in the mind of the researcher about the choice of alternative means.** This implies that research should answer the question relating to the relative efficiency or suitability of the possible alternatives.
- e) There must be some environment(s) to which the difficulty pertains.

Selecting the Problem

**What should
you consider
when selecting
a Research
Problem??**



SELECTING THE PROBLEM

- The research problem undertaken for study must be carefully selected. The task is a difficult one although it may not appear to be so. Help may be taken from a research guide in this connection.
- Nevertheless, every researcher must find out his own salvation for research problems cannot be borrowed.
- A problem must spring from the researcher's mind like a plant **springing from its own seed**.



Selecting the Problem

- However, the following points may be observed by a researcher in selecting a research problem or a subject for research:
 - (i) Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.
 - (ii) Controversial subject should not become the choice of an average researcher.
 - (iii) Too narrow or too vague problems should be avoided.
 - (iv) The subject selected for research should be familiar and feasible so that the related research material or sources of research are within one's reach.

- Even then it is quite difficult to supply definitive ideas concerning how a researcher should obtain ideas for his research.
- For this purpose, a researcher should contact an expert or a professor in the University who is already engaged in research.
- He may as well read articles published in current literature available on the subject and may think how the techniques and ideas discussed therein might be applied to the solution of other problems.
- He may discuss with others what he has in mind concerning a problem. In this way he should make all possible efforts in selecting a problem.

(v) The importance of the subject, the qualifications and the training of a researcher, the costs involved, the time factor are few other criteria that must also be considered in selecting a problem.

In other words, before the final selection of a problem is done, a researcher must ask himself the following questions:

- (a) Whether he is *well equipped in terms of his background* to carry out the research?
- (b) Whether the *study falls within the budget* he can afford?
- (c) Whether *the necessary cooperation* can be obtained from those who must participate in research as subjects?

If the answers to all these questions are in the affirmative, one may become sure so far as the practicability of the study is concerned.

(vi) The selection of a problem must be preceded by a preliminary study. This may not be necessary when the problem requires the conduct of a research closely similar to one that has already been done.

But when the *field of inquiry is relatively new* and does not have available a set of well-developed techniques, a brief feasibility study must always be undertaken.

NECESSITY OF DEFINING THE PROBLEM

A problem well defined is half solved



NECESSITY OF DEFINING THE PROBLEM

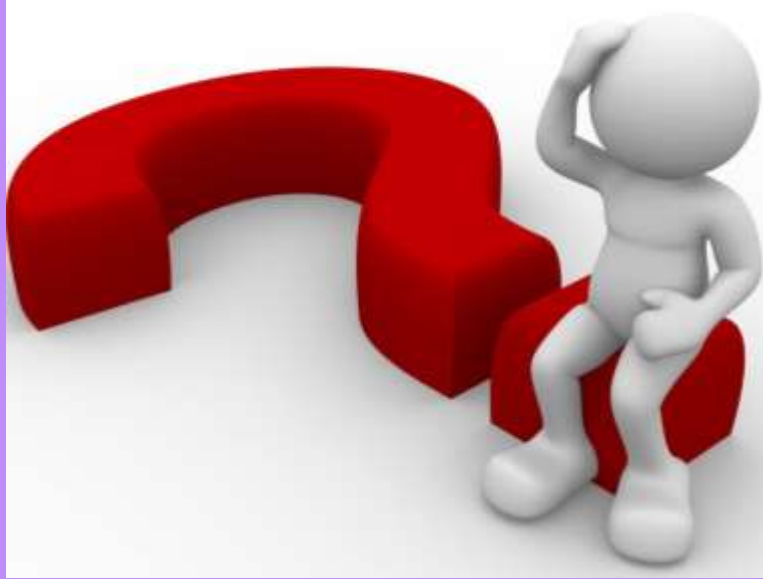


- Quite often we all hear that a problem clearly stated is a problem half solved.
- This statement signifies the need for defining a research problem.
- The problem to be investigated **must be defined unambiguously** for that will help to discriminate relevant data from the irrelevant ones.
- A proper definition of research problem will enable the researcher to be on the track whereas an ill-defined problem may create hurdles.



- ✓ **Questions like:** What data are to be collected? What characteristics of data are relevant and need to be studied? What relations are to be explored.
- ✓ **What techniques are to be used for the purpose?** and similar other questions crop up in the mind of the researcher who can well plan his strategy and find answers to all such questions only when the research problem has been well defined.

NECESSITY OF DEFINING THE PROBLEM



- Thus, defining a research problem properly is a prerequisite for any study and is a step of the highest importance.
- In fact, formulation of a problem is often more essential than its solution.

- It is only on careful detailing the research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

TECHNIQUE INVOLVED IN DEFINING A PROBLEM



TECHNIQUE INVOLVED IN DEFINING A PROBLEM

- ❖ Defining a research problem properly and clearly is a crucial part of a research study and must in no case be accomplished hurriedly.
- ❖ However, in practice this is a frequently overlooked which causes a lot of problems later on.
- ❖ Hence, the research problem should be defined in a systematic manner, giving due weightage to all relating points.

The technique for the purpose involves the undertaking of the following steps generally one after the other:

- (i) statement of the problem in a general way;
- (ii) understanding the nature of the problem;
- (iii) surveying the available literature
- (iv) developing the ideas through discussions; and
- (v) rephrasing the research problem into a working proposition

TECHNIQUE INVOLVED IN DEFINING A PROBLEM

(i) Statement of the problem in a general way:

- First of all the problem should be **stated in a broad general way**, keeping in view either some practical concern or some scientific or intellectual interest.
- For this purpose, the researcher must immerse himself **thoroughly in the subject matter** concerning which he wishes to pose a problem.



- In case of social research, it is considered advisable **to do some field observation** and as such the researcher may undertake some sort of **preliminary survey or what is often called pilot survey**.
- Then the **researcher can** himself state the problem or he can seek the guidance of the **guide** or the **subject expert** in accomplishing this task.
- Often, **the guide puts forth the problem in general terms**, and it is then up to the **researcher to narrow it down and phrase the problem in operational terms**.

TECHNIQUE INVOLVED IN DEFINING A PROBLEM

(ii) Understanding the nature of the problem:

- ❖ The **next step** in defining the problem is **to understand its origin and nature clearly**.
- ❖ **The best way of understanding** the problem is **to discuss it** with **those who first raised it** in order to find out **how the problem originally came about** and with what objectives in view.
- ❖ **If the researcher has stated the problem himself**, he should **consider once again** all those points that induced him to make a general statement concerning the problem.



- ❖ **For a better understanding of the nature of the problem involved**, he can enter into discussion with those who have a good knowledge of the problem concerned or similar other problems.
- ❖ The **researcher should also keep in view the environment** within which the problem is to be studied and understood.

(iii) Surveying the available literature:

- All available literature concerning the problem at hand must necessarily be surveyed and examined before a definition of the research problem is given.
- This means that the researcher must be well-conversant with relevant theories in the field, reports and records as also all other relevant literature.
- He must devote sufficient time in reviewing of research already undertaken on related problems.
- This is done to find out what data and other materials, if any, are available for operational purposes – helps to narrow the problem.
- This would also help a researcher to know if there are certain gaps in the theories, or whether the existing theories applicable to the problem under study are inconsistent with each other.



TECHNIQUE INVOLVED IN DEFINING A PROBLEM

(iv) Developing the ideas through discussions:

- ✓ Discussion concerning a problem often **produces useful information**.
- ✓ Various new ideas can be developed through such an exercise.
- ✓ Hence, a researcher must discuss his problem with his colleagues and others who have enough experience in the same area or in working on similar problems.
- ✓ This is quite often known as an experience survey.



- ✓ People with rich experience are in a position to enlighten the researcher on different aspects of his proposed study and their advice and comments are usually invaluable to the researcher.
- ✓ They help him sharpen his focus of attention on specific aspects within the field.
- ✓ Discussions with such persons should **not only be confined to the formulation of the specific problem** at hand, **but should also be concerned with the general approach** to the given problem, techniques that might be used, possible solutions, etc



(v) Rephrasing the research problem:

- ❑ Finally, the researcher must sit to rephrase the research problem into a working proposition.
- ❑ Once the nature of the problem has been clearly understood, the environment (within which the problem has got to be studied) has been defined, discussions over the problem have taken place and the available literature has been surveyed and examined, rephrasing the problem into analytical or operational terms is not a difficult task.

TECHNIQUE INVOLVED IN DEFINING A PROBLEM

In addition to what has been stated above, the following points must also be observed while defining a research problem:

- (a) **Technical terms and words or phrases**, with special meanings used in the statement of the problem, should be clearly defined.
- (b) **Basic assumptions or postulates** (if any) relating to the research problem should be clearly stated.
- (c) **A straight forward statement of the value** of the investigation (i.e., the criteria for the selection of the problem) should be provided.
- (d) **The suitability of the time-period and the sources of data** available must also be considered by the researcher in defining the problem.
- (e) **The scope of the investigation or the limits** within which the problem is to be studied must be mentioned explicitly in defining a research problem.

AN ILLUSTRATION

The technique of defining a problem outlined above can be illustrated for better understanding by taking an example as under:

Let us suppose that a research problem in a broad general way is as follows:

- ❑ “Why is productivity in Japan so much higher than in India”?
- ❑ In this form the question has a number of ambiguities such as:
 - What sort of productivity is being referred to?
 - With what industries the same is related?
 - With what period of time the productivity is being talked about?
- ❑ In view of all such ambiguities the given statement or the question is much too general to be amenable to analysis.

Rethinking and
discussions about
the problem

:“What factors were responsible for the higher labour productivity of Japan’s manufacturing industries during the decade 1971 to 1980 relative to India’s manufacturing industries?”

AN ILLUSTRATION

- This latter version of the problem is definitely an improvement over its earlier version for the various ambiguities have been removed to the extent possible.
- Further rethinking and rephrasing might place the problem on a still better operational basis as shown below:
- “To what extent did labour productivity in 1971 to 1980 in Japan exceed that of India in respect of 15 selected manufacturing industries? What factors were responsible for the productivity differentials between the two countries by industries?”.
- With this sort of formulation, the various terms involved such as ‘labour productivity’, ‘productivity differentials’, etc. must be explained clearly. The researcher must also see that the necessary data are available.

THE END